

# Environmental Effects & Information Needs of Alternative Energy Uses on the OCS

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# Objectives of MMS Study

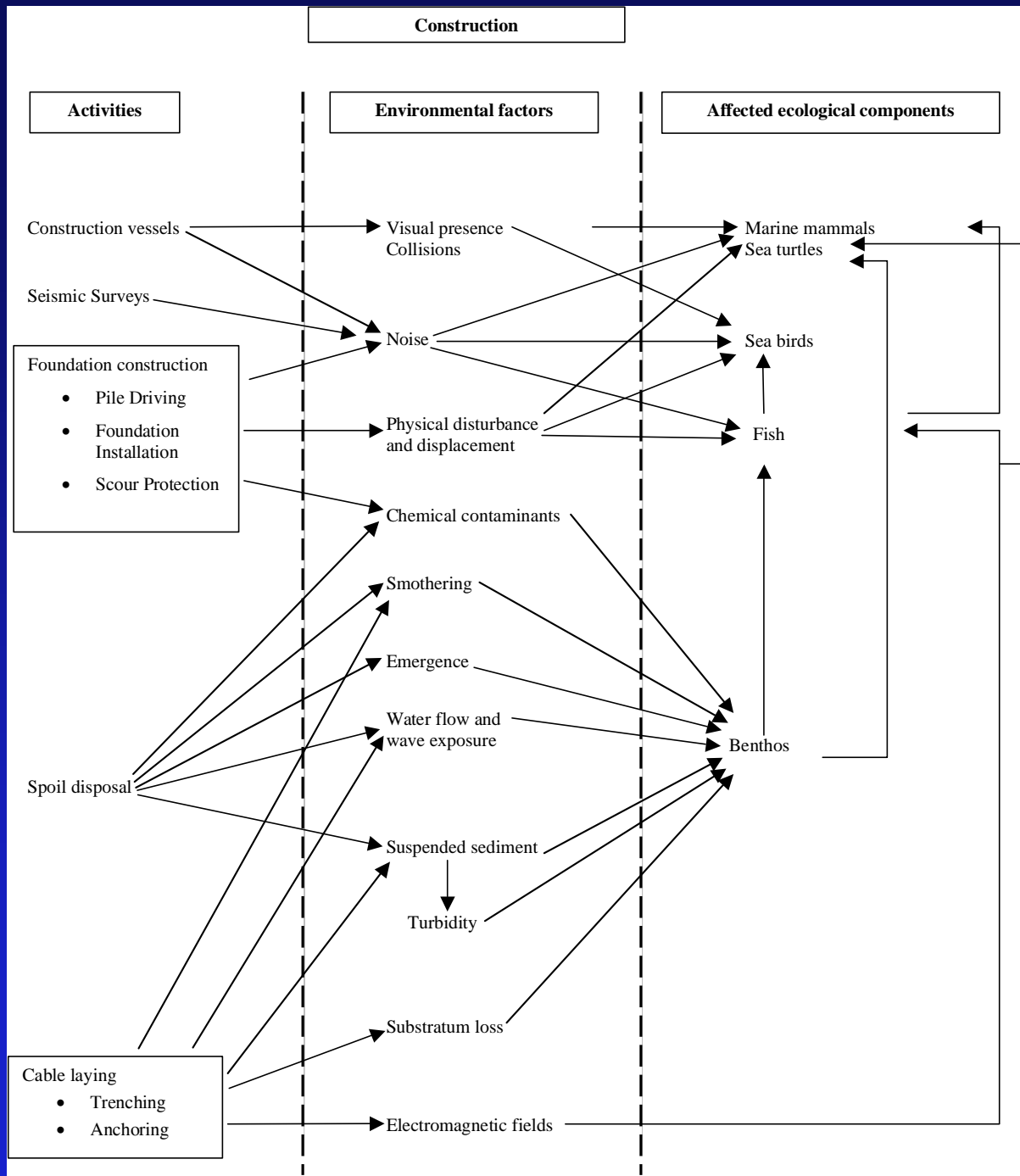
- 1) Current offshore energy technologies and future trends
- 2) Public acceptance
- 3) Potential direct, indirect, cumulative environmental effects
- 4) Mitigation measures
- 5) Models to determine impacts
- 6) Information needs to address data gaps

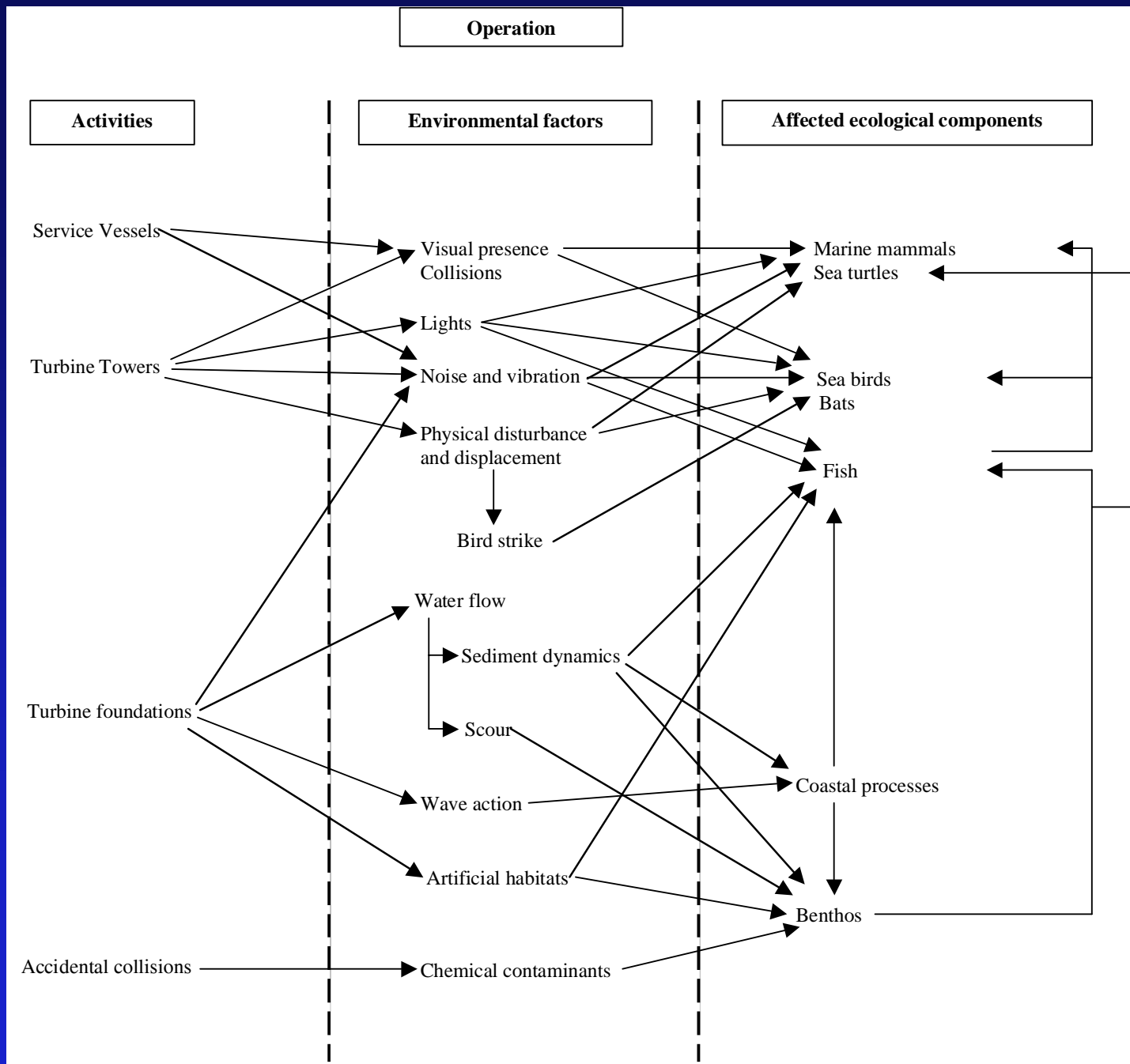
# Impacts to...

- 1) Physical processes
- 2) Benthic resources
- 3) Fishery resources
- 4) Marine mammals
- 5) Sea turtles
- 6) Flying animals
- 7) Space-use conflicts
- 8) Aesthetics

# Types of Impacts

- 1) Habitat change
- 2) Attraction/avoidance
- 3) Collision/entanglement/entrainment
- 4) EMF
- 5) Noise/vibration
- 6) Contaminants
- 7) Lost use





# Habitat Change

- New substrate (hard and structurally complex)
- Pelagic to fixed reef communities
- Substrate change from scour/deposition (thus infaunal community change)
- Range extension of invasive species

How to determine ecological significance of changes

# Foundation Types

## Proven Shallow Water Designs



**Monopile Foundation**

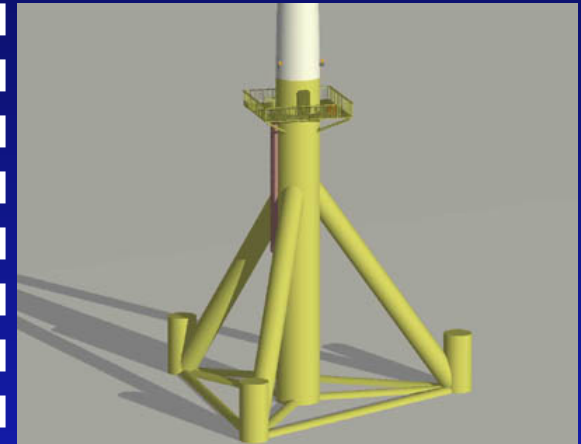
- Most Common Type
- Minimal Footprint
- Depth Limit 25 m
- Low stiffness



**Gravity Foundation**

- Larger Footprint
- Depth Limit 20 m
- Stiffer but heavy

## Transitional



**Tripod/Truss Foundation**

- No wind experience
- Oil and gas to 450 m
- Larger footprint

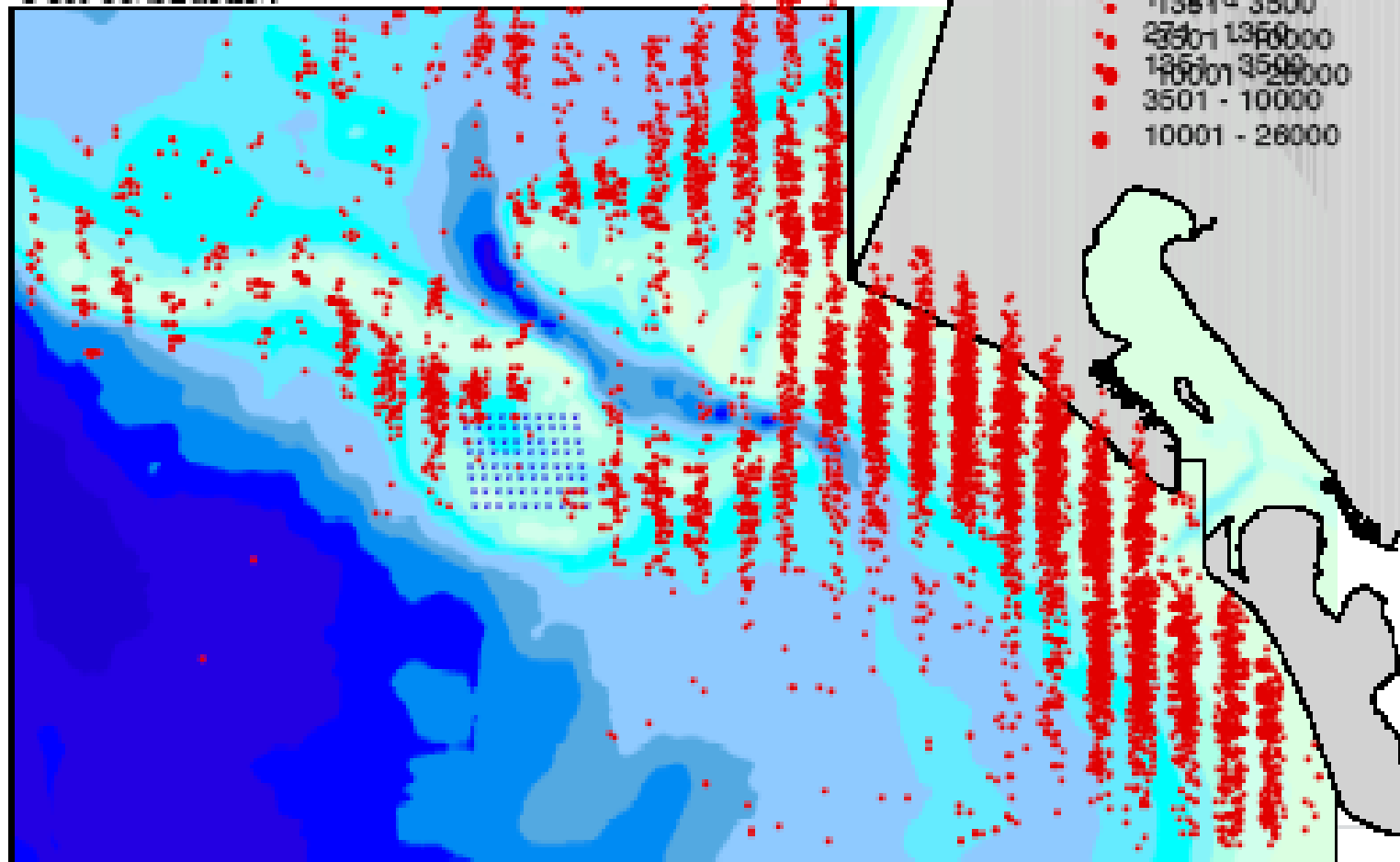
# Attraction/ Avoidance

- Lighting
- Structures
- Prey abundance

Pre-construction

## Common Scoter

Post-construction



# Collision/Entanglement/ Entrainment

- Collision with blades - birds, bats
- Floating units lines and anchors - marine mammals, sea turtles
- Overtopping wave devices - fish entrainment
- Prey concentration - sea turtles, birds, mammals
- Increased construction and maintenance vessel traffic

# Wave Devices

- Point Absorber



- Attenuator



- Oscillating Water Column



- Overtopping



# EMF

- Wind farms can have >50 km of cables
- Elasmobranches most sensitive
  - Avoidance or attraction
  - Feeding or migratory behavior
- Marine mammal and sea turtle migration ?
- Effects on benthic communities

# Noise/Vibration

- Pile driving during construction - acute impacts to marine mammals, sea turtles, fish
- Operational noise of turbines - communication, prey location, other on marine mammals, fish
- Maintenance - increased vessel traffic

# Contaminants

- Oil spills from increased vessel traffic
- Antifouling coatings on wave and current devices

# Info Needs - SC Ocean Mapping

- Distribution and abundance of natural resources
- Navigation
- Commercial and recreational fisheries
- Cultural resources
- Other seafloor issues
  - Cables
  - Dredging borrow/disposal sites

# Info Needs - Physical Resources

- Maps of wind, wave, and ocean current resources suitable to support alternative energy extraction
- Background seabed characteristics, sediment dynamics (esp. on sand shoals)
- Shoreline morphology monitoring
- Guidance on what levels of change are acceptable

# Info Needs - Benthic Resources

- Benthic habitat maps of spatially recognizable areas with distinct physical, chemical, and biological environments for siting and regional assessments
- Coordinate with National Benthic Habitat Mapping Program
  - Protocols
  - Work in pilot areas

# Info Needs - Fishery Resources

- Fishery habitat maps - close linkage to benthic habitat maps
- Predator-prey interactions
- Close coordination with FMCs
- New methods for baseline monitoring to support impact assessment (past studies too limited spatially and temporally)
- Alternative energy sites as de facto MPAs?

# Info Needs - Marine Mammals

- Baseline studies for key species (right whale, humpback whale)
  - Platforms/methods for improved monitoring and assessment
  - Dynamic models that link environmental conditions to sightings
  - Sampling resolution and study duration for sufficient baseline data
- Lots of data but usually too coarse to assess site-specific impacts

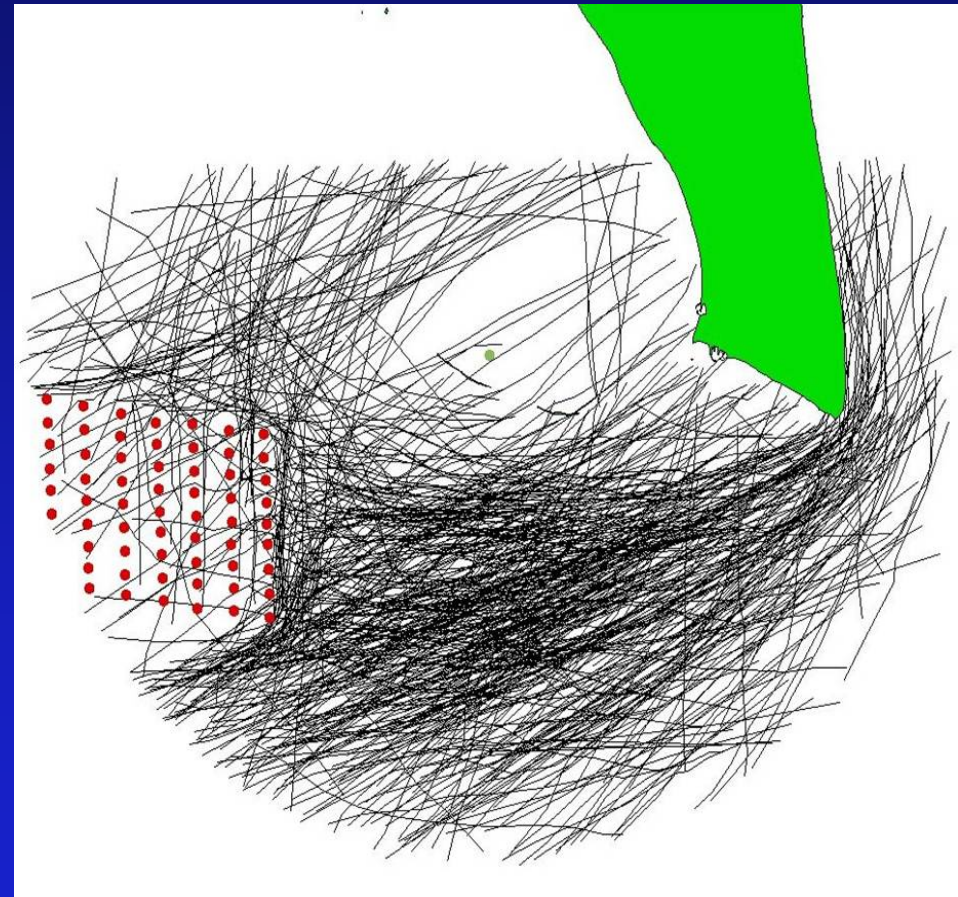
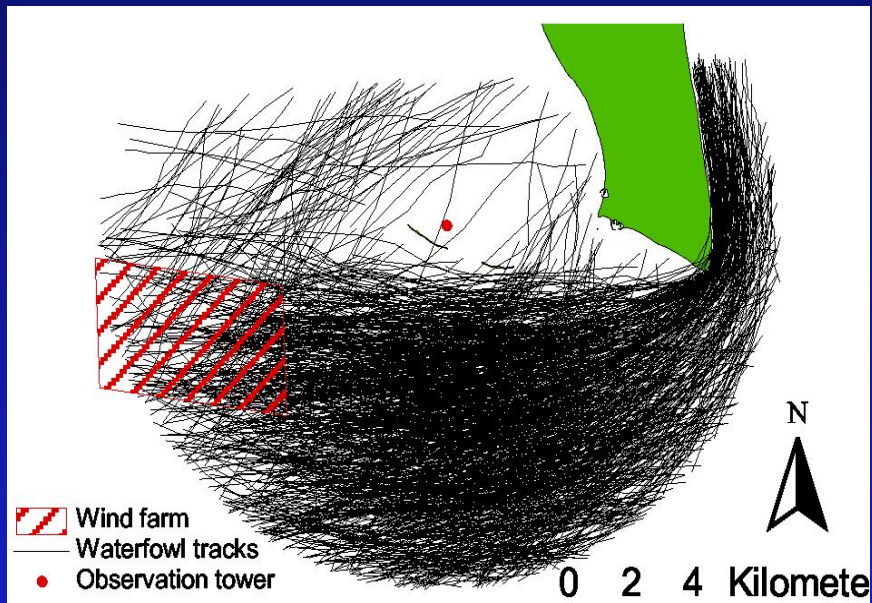
# Info Needs - Sea Turtles

- Baseline studies high priority areas
  - Density
  - Importance
  - Specific uses
  - Migration routes
- Long-term studies to address high spatial and temporal variations

# Info Needs - Birds

- Baseline data on distribution, abundance, temporal patterns for on-water and in-air movements/behavior
  - Define flyways
  - Determine flight height
  - Diurnal and nocturnal movements
  - Foraging and wintering use offshore
  - Effects of weather

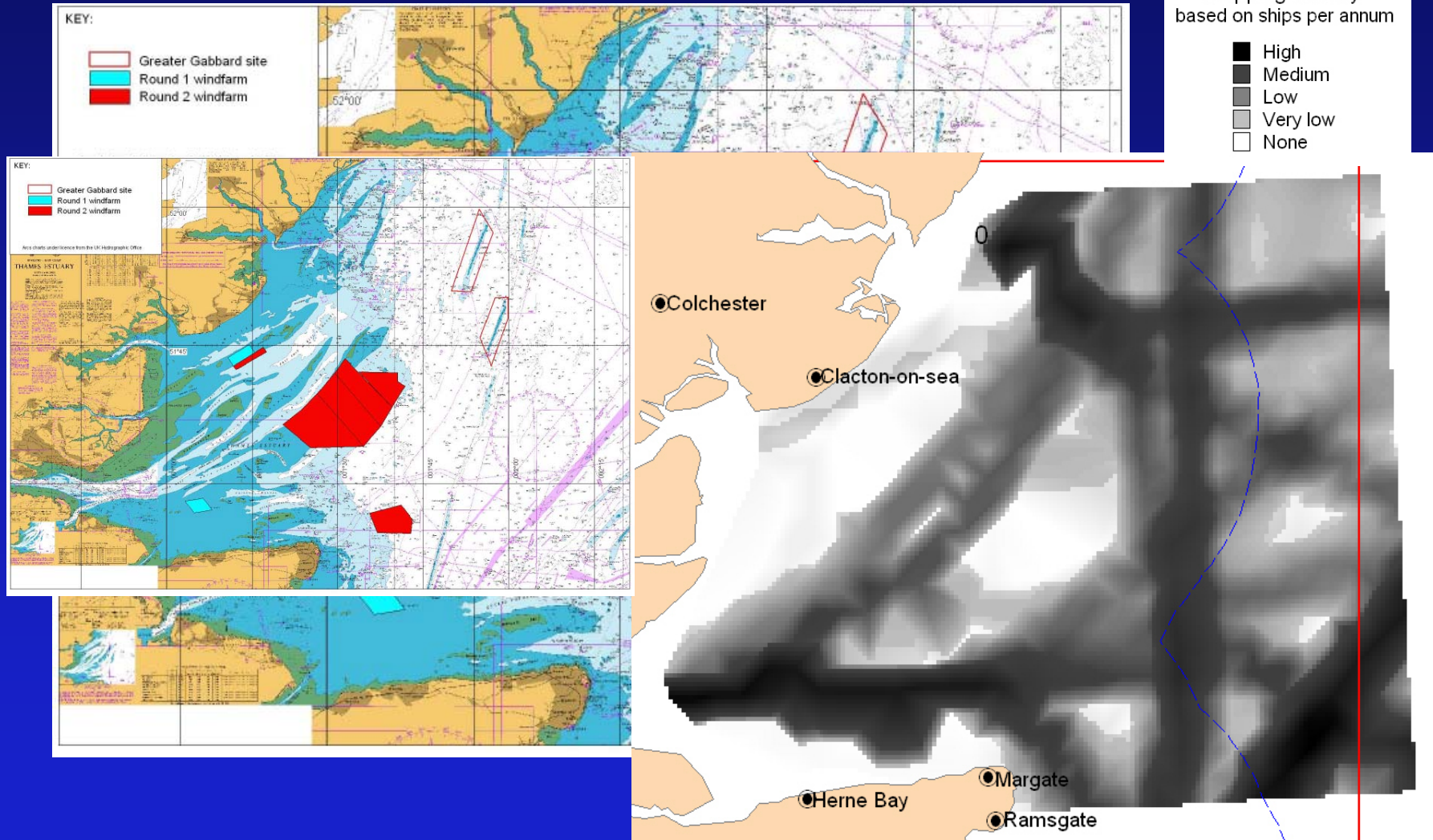
# Birds – radar observations



# Info Needs - Socio-Economics

- Baseline data for siting and assessment
  - Commercial/recreational fishing
  - Marine recreational use
  - Sand and gravel extraction
  - Navigation
  - Aquaculture
- Space-use conflicts (commercial fisheries exclusion zone, either formal or de facto)

# Case Study 1: Thames Estuary Projects



# MMS Reports

Michel, J. et al. 2007. Worldwide Synthesis and Analysis of Existing Information Regarding Environmental Effects of Alternative Energy Uses on the Outer Continental Shelf. U.S. Department of the Interior, Minerals Management Service, Herndon, VA, MMS OCS Report 2007-038. 254 pp.

Michel, J. and Burkhard, E. 2007. Workshop to Identify Alternative Energy Environmental Information Needs: Workshop Summary. U.S. Department of the Interior, Minerals Management Service, Herndon, VA, MMS OCS Report 2007-057. 55 pp. + app.